

Validation articles

- Ashcraft C.M. et al. "A Test of Validity of a New Open-Circuit Indirect Calorimeter." J Parenter Enteral Nutr. 2014 Mar 10
- Sundström M et al. "Indirect calorimetry in mechanically ventilated patients. A systematic comparison of three instruments." J. Clin Nutr. 2013 Feb;32(1):118-21
- Blond E. et al. "A new indirect calorimeter is accurate and reliable for measuring basal energy expenditure, thermic effect of food and substrate oxidation in obese and health " e-SPEN e-Journal of Clinical Nutrition and Metabolism 6 (2011) e7ee15
- More scientific studies on [www.cosmed.com/bibliography](http://www.cosmed.com/bibliography)

Technical Specifications

Product	Description	REF
Quark RMR	Indirect Calorimetry Laboratory	C09074-01-99
Standard packaging	Quark RMR unit, Canopy hood (with veil), Turbine Flowmeter (2 pcs.) w/ sampling line, antibacterial filters, OMNIA PC software, calibration syringe, HR monitor (receiver and transmitter), power supply cable, USB cable, user manual	
Standard Tests		
Indirect Calorimetry	Resting Energy Expenditure (REE, RMR), w/ canopy hhood, face mask or mouthpieces-antibacterial filter, Respiratory Quotient (RQ), Substrates Analysis (%FAT, %PRO, %CHO)	
Flowmeter	Turbine Ø-18mm (Canopy/Mask)	Flow-REE (ICU) - Optional
Type	Bidirectional Digital Turbine	Disposable PNT (Lilly)
Flow Range	0-8 l/s	0-1,7 l/s
Accuracy	± 2% or 20 ml/s (flow) ± 2% or 100 ml/min (ventil.)	± 2 %
Resistance	<0.27 cmH <sub>2</sub> O/l/s @ 1 l/s	<2,35 cmH <sub>2</sub> O/l/s @ 1 l/s
Visualization resolution	4 ml/s	1 ml/s
Gas Analyzers	O <sub>2</sub>	CO <sub>2</sub>
Type	Paramagnetic	NDIR
Range	0-100% (Standard 0-30% - ICU 0-70% - or user defined)	0-10%
Accuracy	± 0.02 %	± 0.02 %
Response time	100 ms	100 ms
Hardware		
Dimensions & weight	Unit: 17 x 30 x 45 cm/8 Kg    Canopy: 32 x 50 x 30 cm/0.6 Kg	
Interface ports	USB A-B, RS-232, HR-TTL, SpO2	
Electrical requirements	100-240V ± 10% 50/60 Hz	
Internal emergency battery	12V; 1,2 Ah	
Environmental conditions	Temperature 0-50 °C (32 - 122 °F); Barometer 400-800 mmHg; Humidity 0-100%	
Software	OMNIA	
Available languages	Italian, English, Spanish, French, German, Portuguese, Greek, Dutch, Turkish, Russian, Chinese (Traditional), Chinese (Simplified), Korean, Romanian, Polish, Czech, Norwegian	
PC Configuration	I3 or higher processor speed. Compatible with Windows 7, 8, 8.1, 10 (32 or 64 bit). RAM 4GB (8GB recommended). HD with 4GB of free space (plus tools)	
Modules	Description	REF
ICU kit for vent Patients	Allowing Quark RMR measurement of REE in patients undergoing mechanically assisted ventilation.	C03610-01-11
Mixing Chamber	7 liters Mixing Chamber (physical)	C03261-01-11
Accessories & Options	Description	REF
Gas Calibration Kit	Gas cylinder required for O <sub>2</sub> /CO <sub>2</sub> calibration (16% O <sub>2</sub> , 5% CO <sub>2</sub> , N <sub>2</sub> bal) and a pressure regulator	A-860-000-004 (Gas) A-870-150-005 (Regul.)
Pulse Oximetry	Oximeter (Xpod) requires probe Oximeter ipod (w/ finger probe)	C02600-01-05 C02390-01-05
Ethanol Burning Kit	Kit consists of a glass ampoule for the verification of respiratory quotient	C03471-01-11
Medical Cart	Medical-graded with isolation transformer (according to MDD directive). Designed to hold the whole equipment during bedside applications.	C03550-01-04 (230VAC) C03550-02-04 (120VAC)
Safety & Quality Standards		
MDD (93/42 EEC); FDA 510(k); EN 60601-1 (safety) / EN 60601-1-2 (EMC)		

Quark RMR

Indirect Calorimetry

The new standard for Resting Energy Expenditure measurement in research and clinical practice



“Calories, you can't manage what you don't measure”



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COSMED  
The Metabolic Company

“Quark RMR was demonstrated to be unbiased, precise, reproducible, and accurate device for measuring energy expenditure<sup>(1)</sup>”

- Measurement of Resting Energy Expenditure (REE) & substrates
- REE by dilution with canopy
- REE breath by breath by face mask
- Optional kit for measuring REE in mechanically assisted patients
- Suitable for patients above 15kg of weight
- Independent validated on spontaneously breathing subjects and on mechanically ventilated patients



### REE on spontaneously breathing subjects

### REE by dilution with Canopy Hood

The Quark RMR is supplied with a dilution helmet for the measurement of the expiratory flow of patients with spontaneous breathing. This method does not require a mouthpiece or facemask and is more comfortable for obese patients. Gas is sampled at the expiratory port through a sampling line, while the ventilation is measured by a turbine. The ventilation output of the helmet is easily regulated in order to maintain the  $\text{CO}_2$  expired fraction ( $\text{FeCO}_2$ ) within a prefixed range of values.

- Bidirectional digital turbine flowmeter (reusable).
- "Bubble" canopy hood (18,7 L) with removable blanket.
- Integrated canopy blower pump inside the main unit (selectable flow rate).
- Internal emergency battery with acoustic alarms.
- Optional canopy hood kit for pediatric use (15-30 kg).

### REE breath by breath by Face Mask

In addition to canopy, Quark RMR allows “breath-by-breath” gas exchange analysis by using multi-use silicone face masks (available in 5 sizes: 3 adult, 2 pediatric), or, alternatively, with mouthpiece and AB filter.

## REE on mechanically ventilated patients

The optional ICU module for Quark RMR allows the integration with the ventilator for the measurement of REE in patients undergoing mechanically assisted ventilation in intensive care units. The module is extremely versatile allowing two different set-ups according to specific testing requirements.

### In-line Measurement within Patient's Circuit

- Disposable low-flow range PNT flowmeter (Flow-REE) inserted at the patient's circuit
- "Breath by breath" gas sampling through a line connected proximally to the Y-piece of the ventilator tubing
- Inspiratory and expiratory phases directly measured by the flowmeter
- All parts are single patient, no need for cleaning and disinfecting
- $\text{FiO}_2 \leq 70\%$
- Independent from type of ventilator in use

### External Flow Measurement by Ventilator's outlet

- Patient minute ventilation measured by a turbine flowmeter connected to the expiratory port of the ventilator
- “Breath by breath” gas sampling through a line connected proximally to the Y-piece of the ventilator tubing
- Software allows users to detect the “Bias Flow” and identifies the inspiratory and expiratory phases with the use of an algorithm based on flow and expiratory CO<sub>2</sub> analysis
- Easy and less invasive set-up
- Lower costs with less consumables
- Compatible with most of ventilators in the market

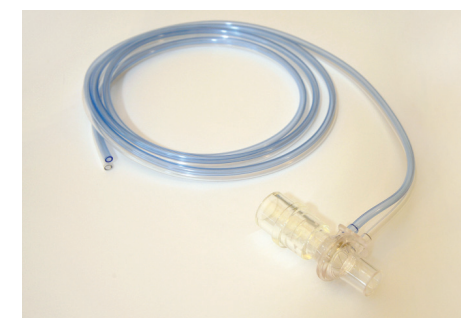
## Data Management & Software

Quark RMR comes with the OMNIA Metabolic Module, the new software designed by COSMED. Compatible with the entire COSMED product range, OMNIA allows the user to operate complex equipment without requiring long learning paths.

- Easy-to-use beautifully designed touch-screen (native) graphic user interface with intuitive workflow and hierarchy.
- Manage/display data and plots via Dashboards (default and user defined).
- Select and define charts, data and widgets.
- Powerful chart creation (up to 4 Y axis and one X axe) with full control on settings.
- Change blower settings directly from dedicated widget.
- Select time interval to display averaged parameters (REE, RQ, variability, etc.) both in real time and in post analysis.
- Designed to work with both standard PC and tablets.
- SQL Database allowing virtually unlimited records and data safety.
- Full Network Database Management (optional). OMNIA allows installations in complex Server/Client environments.
- Multi-users access rights management (Principal Investigator, Physician, Technician, Administrator...) with event logging.
- Compatible with Win 7,8, 8.1, 10 (32/64). Mac OS compatibility when installed in Virtual PC OS (Parallel, VMware).

## Options

- **Exercise Testing Kit.** With the optional CPET (Cardio Pulmonary Exercise Testing) module users can perform full exercise protocols to measure  $\text{VO}_2$  and  $\text{VCO}_2$  up to maximal effort.
- **Ethanol burning kit.** It consists of a lamp, parts and connectors to be connected to the Quark RMR. Burning ethanol generates a predictable ratio of  $\text{VO}_2$  and  $\text{VCO}_2$  and it can be used to verify the Quark RMR accuracy of Respiratory Quotient measurement.



Disposable flowmeter (Flow-REE) inserted at patient's circuit during testing in ICU settings



*Alternatively to the canopy hood, REE can also be measured on spontaneously breathing subjects using a multi-use silicone face mask (5 sizes available)*



*An alternative test method connects the turbine directly with a mouthpiece and an antibacterial filter*

The Quark RMR is a compact bed-side indirect calorimetry solution designed to allow accurate and instantaneous estimation of Resting Energy Expenditure (REE) and respiratory ratio (R), in a non-invasive way, through the measurement of oxygen consumption ( $\text{VO}_2$ ), carbon dioxide production ( $\text{VCO}_2$ ), together with other ventilatory parameters, and metabolism substrate utilization (%FAT, %PRO, %CHO). Quark RMR allows thus improved nutrition support and accurate planning of nutritional therapies.

Quark RMR is a modern device suitable both for research and clinical applications. By measuring REE and providing the correct energy balance in critically ill patients, hospital may improve patient outcome, and decrease the length of hospitalization which will have a significant and immediate impact on hospital bottom line. Scientific evidence highlights that negative energy balances are correlated with increasing number of complications, particularly infections.<sup>(2)</sup>

Quark RMR accuracy and reliability have been validated against Gold Standard methods either with spontaneously breathing subjects and with mechanically assisted patients.

## Design

- **Latest technology in gas analyzers:** paramagnetic, stable and durable for the  $O_2$ ; rapid infrared for the  $CO_2$ . Both analyzers are reliable and do not need maintenance for long periods.
- **Flowmeters (disposable pneumotach and multi-use turbine)** guarantee great accuracy on the different measurement modes (canopy, mask and through mechanical ventilation).
- **Quick and user-friendly calibration procedures** guarantee accurate measurements either on flow/volume (using the 3-liter calibration syringe) and gas concentration.
- **Ideal for bed-side applications** Quark RMR compact dimensions and the optional medical graded cart configuration, make it the ideal choice for bed-side applications.
- **Powered by OMNIA software** innovative user interface, touch screen ready, easy-to-use and self-explanatory.

<sup>(1)</sup> Ashcraft C.M. et al. "A Test of Validity of a New Open-Circuit Indirect Calorimeter." *J Parenter Enteral Nutr.* 2014 Mar 10

(2) Villet S et al "Negative impact of hypocaloric feeding and energy balance on clinical outcome in ICU patients" *Clin Nutr.* 2005 Aug;24(4):502-9.